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Annual Report

OF THE

Department of Agriculture

For the Year 1933.

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DEPARTMENT OF AGRICULTURE.

Report for 1933.

PART I—AGRICULTURAL ADMINISTRATION AND PROGRESS.

The estimated expenditure for the working of the department for the year 1933 was £16,096 as compared with £21,402 for 1932. Work during the year proceeded quietly and good progress was made.

2. *Staff.*—The department was under the charge of Mr. A. H. Kirby till May 14th, on which date this officer went on leave pending retirement. The post of Director was not filled during 1933, but the writer acted as Director after Mr. Kirby's departure until the end of the year, when he was promoted to fill the vacancy. Mr. Kirby who came to this Colony in 1930 brought a wealth of experience from East Africa. He retired from the Service after three years and the wishes of the department go with him. In view of the proposed decrease in the vote for 1934, Mr. P. J. Moss was allowed to go on voluntary retirement on December 1st. This retirement of one Agricultural Officer was allowed before it was known that the appointment of Director of Agriculture would be filled by an officer serving in this Colony. Mr. Moss left the Colony on the 28th of June, pending retirement. In all, he spent some seven years with the department and we wish him the best of luck.

The loss of two officers from the staff of the department, coupled with the intimation from Government that the Estimates for 1934 would have to be reduced to £15,000 a year, necessitated a reorganization of the agricultural staff. The two circles in the Southern Province were united into one with their headquarters at Njala, and the two in the Northern Province into one with headquarters at Makeni. This proved far more satisfactory, and was in fact only putting into effect one of the recommendations made by the Agricultural Adviser to the Secretary of State (Mr. F. A. Stockdale, C.M.G., O.B.E.) on the occasion of his visit to Sierra Leone in 1929.

In spite of shortage of staff and the cutting down of the financial provision for all forms of assistance, the Agricultural Officers have worked extremely hard to keep in being and carry forward as far as possible all the forms of activity commenced by the department. The reports of individual officers, which form Part II of this report, very strongly emphasize this point. Work on wet-land rice, the establishment of small plantations of oil-palm, of coffee, and the distribution of the better types of the food crops commonly grown, has been maintained. This assistance has been much appreciated by the local farmers.

The illiterate instructors drafted into the department during the last two years have not justified the high hopes and encomiums expressed in the last report. There existed no scheme for the efficient training of these instructors and, furthermore, it is extremely difficult to inculcate new ideas into the minds of illiterate men of mature years. A scheme for the employment of educated sons of native farmers, after receiving a course of agricultural instruction, has consequently been put forward, and will be brought into effect in 1934. By the simple process of using Agricultural Assistants of the old (i.e. educated) type in the districts and among the tribes speaking the same language as those from which they came, the language difficulty mentioned in the last annual report was overcome. After a conclusive trial of over two years it is the unanimous opinion of all officers of the department that the difficulties of training, communicating with and obtaining lucid reports from illiterate instructors are too great to be overcome, and it has been found once again that education is a real asset to progress in agricultural undertakings.

Rice.—The development of swamp-rice continues and the country has never been better supplied with rice than at the present time. At last it can be said with considerable assurance that the hungry season (from which Sierra Leone has suffered so badly in the past) has gone for ever. In fact, so greatly has the growth of rice developed during the last few years that there is every possibility of developing an export trade in this commodity. In order to encourage this a small experimental farm will be opened in January, 1934, in the Scarcies area and the land for this was obtained towards the end of the year.

Oil-palms.—It is sad to record that the enthusiasm for the cultivation of oil-palms is receiving a setback. This is due to the low prices prevailing for palm produce. These low prices are not encouraging, although exports of produce have not fallen off as much as was feared. The figures for 1932 and 1933 are as follows: —

Year.	Tons.	Values. £
	Kernels.	
1932	77,162	687,477
1933	64,084	472,824
	Palm-oil.	
1932	2,208	26,914
1933	1,619	16,537

Progress is being made at Njala with the plantations of different varieties of oil-palm established there, and the records from individual trees show which should prove the most suitable parent stock.

Kola.—There are now no markets in which to dispose of all our kola and as a result of the low prices the people are discouraged from extending its cultivation. Moreover, the import duties into

French countries and the financial difficulties of Nigeria makes it difficult to see where markets will be found in the near future. During the year the exports were 1,812 tons valued at £43,656, as compared with as much as 3,127 tons in 1929 valued at £266,422.

Ginger.—This crop has also suffered badly, but the amount exported has not fallen as much as might have been expected. The value has fallen, however, and in 1933 the export of 1,545 tons was only valued at £16,543.

Piassava.—This is perhaps the only industry which preserved its position in 1933, and if the price is not quite so high as five years ago the decrease is not so great as in other products. The better prices are mainly due to propaganda for the better cleaning, and the inspection of fibre before export, so that the price of our produce has gone up in comparison with that of other producing countries. Inspection has now been in force five years and the export figures below are therefore of considerable interest:—

Year.	Tons.	Value. £
1929	1,232	17,177
1930	2,417	36,582
1931	3,150	31,846
1932	2,877	23,290
1933	3,499	30,108

The quantity exported in 1933 was a record.

Fruit Exports.—In 1933 experimental shipments of oranges were made. Those made in the early part of the year indicated that although our oranges were of good quality as regards flavour, etc., their green colour militated against a ready sale. During the latter part of the year experiments were made with artificial methods of colouring the oranges and it was found that ethylene gas could be easily used to give a satisfactory tint to the oranges. The first small shipments were satisfactorily reported upon, and further shipments were arranged for 1934.

Pine-apples.—Small shipments of pine-apples were made. Those made by the department reached England safely and were suitably reported upon and sold at a reasonable price. Some consignments sent by other exporters reached Engand in a bad condition. This was due chiefly to a lack of care and knowledge on the part of the shippers and legislation was passed (Ordinance No. 25/1933) to regulate the methods of packing all kinds of fruit exported from Sierra Leone.

Njala.—As the reporting officer explains, "practically no work of an *experimental* nature had been planned for the station, and the financial provision was devoted almost wholly to the plantation crops and to cleaning and restoring to a proper state of cultivation those sections of the main farm which had been neglected during the past three years when the farm was on what was known as a maintenance basis." In the absence of a substantive Director this appeared to be the most satisfactory method of dealing with the existing conditions, making prepara-

tions in advance for a fresh start in 1934 on the appointment of a new Director. Captain J. W. D. Fisher, who was in charge of the station for the greater part of the year, made excellent progress in bringing the farm into a more satisfactory condition.

Newton.—The report in pages 25 to 28 shows that work was pushed forward at Newton during the year. The whole scheme has been held up somewhat on account of difficulties with citrus budwood, but that was partly overcome by the end of the year and better progress may be expected in 1934. The poorness of the soil, owing to the lack of the use of organic matter as manure during the last few years, has been a great difficulty. The use of organic matter during the latter part of the year improved the appearance of the bananas and pine-apples, and it is hoped that by systematically incorporating organic matter with the soil it will gradually be brought back into a good condition.

Masanki.—During the year practically all work was stopped at Masanki and it is unfortunate that I have to report that early in the year a part of the plantation suffered from a grass fire. Fortunately this was got under control before it spread through the whole of the farm, and I am glad to record that the trees affected, only suffered a temporary setback. In October the Superintendent of Prisons opened a District Prison at Masanki and the prisoners worked on the plantation as part of their ordinary work. The care of the plantation by prisoners had two advantages—it enabled a fire belt to be brushed round the plantation and so helped to eliminate the risk of fire; and it also gave the prisoners (mostly cultivators from the Colony or Protectorate) some insight into the advantages of plantation methods.

Research.—The reports of the Entomologist and Mycologist show the nature of the work carried out. The Entomologist was on leave during part of the year, but work on citrus, ground-nuts and bananas was carried out during the other part, and progress was made. We still have invasions of locusts but comparatively little damage was done during 1933.

The Mycologist had a very full year's work and his reports on pages 14 to 20 and 23 to 25 testify to the multiplicity of his interests and his energy. We are very fortunate in having in Mr. F. C. Deighton a man whose knowledge of botany and mycology enables him to be of considerable service to us in this dual capacity.

In conclusion, I must draw attention to the excellent way in which, in spite of the many difficulties by the reduction of staff, money and trained native assistants, the Agricultural Officers have struggled to carry on the work of the department. It has meant very hard work, and I must express my appreciation of their unstinted efforts and loyalty to me while I was Acting Director in 1933.

F. J. MARTIN,
Director

PART II—DETAILS OF ASSISTANCE AND PROGRESS.

NORTHERN PROVINCE.

From November, 1932 until 1934, there were two Agricultural Officers in the province, and the area was administered as two separate circles : Mr. G. M. Roddan, at Makump, was in charge of the Northern Circle, and Mr. R. R. Glanville, at Kambia, was in charge of the North-western Circle. The latter officer was on leave from June to December 13th, and in his absence the two circles were merged once more, under Mr. Roddan. In addition to his agricultural duties, Mr, Roddam acted as Assistant District Commissioner, Makeni, from March to July. In the circumstances it was not possible for the Agricultural Officer to devote as much time as could be wished to the supervision of the subordinate field staff during the important rainy season months. Nevertheless, good progress has been made and the prospects for continued agricultural improvement are very encouraging.

The substations at Makump, Batkanu, Kabala and Port Loko were maintained. The substation at Melekuri was closed down but a new one was opened at Kambia. All the existing substations are fulfilling useful purposes; correct cultural methods for field crops are demonstrated and planting material is grown for distribution in the surrounding district. Each station has a small area of wet-land which is utilized for rice in the rainy season, and for garden crops in the dry season.

A list of planting material distributed will be found in Appendix I. In most cases much more could have been distributed were it not for the limited supply available.

The practice of distributing planting material on loan was continued and extended. Yams, seed rice, cassava and Canary bananas were given out to 313 farmers. The collection of the loaned planting material after harvest is sometimes tedious, but the experiment on the whole has been a definite success. The poorer farmers benefit greatly by the scheme, which has in addition the following merits: there are no money transactions; the supply of planting material is at least partially maintained from year to year by the farmers themselves, and this eases the work of the substations.

District Work, the main object of which is to afford practical instruction to the farmer on his own land, occupied the greater part of the Instructors' time. One overseer and eight Instructors are now engaged in this work, but when more European supervision can be given it will be profitable to increase the number considerably.

A considerable number of seedlings is grown in the substations for distribution to farmers, but our aim, so far as is feasible, is for the farmers to make their own nurseries under our supervision, and assistance in making and maintaining the plantation is given

in due course. Hundreds of farmers now appreciate and use the methods we have taught them in connection with the establishment of coffee, cacao, oil-palm, etc. The number of farmers who received regular assistance during the year was 570, made up as follows: Bombali 264, Karene 48, Koinadugu 32, Port Loko 154 and Kambia 72.

The farmers are evincing an ever increasing interest in Coffee, and the prospects for this crop are definitely bright. The Robusta type only is being encouraged. In 1929 the first plantations were made near Magburaka; these are beginning to bear. A quantity of about 80 lb. which was sold locally realized $7\frac{1}{2}d.$–$8d.$ per lb., even $3d.$ to $4d.$ per lb. would be a very acceptable return in these hard times. In 1933 87 plantations (11,211 trees) and 198 nurseries were made.

No further Cacao nurseries have been made under our supervision as coffee is considered to be a more remunerative crop, but there are over 100 young but satisfactory plantations in the southern Bombali chiefdoms and prepared beans are now being marketed in small quantities.

Further requests for assistance in making plantations of Nigerian Oil-palm were received, and during the year 18 nurseries and 36 new plantations were made. Some of the plantations made in previous years are poor but the majority are quite satisfactory.

There was an increased demand for Fruit Trees. 231 citrus trees and 104 miscellaneous trees were distributed; of the latter number over 50 were Jak trees.

The demand for seed of better varieties of Wet-land Rice was very keen and 74 bushels were divided among 194 farmers, of which number 132 received small quantities of the best of the Indian rices which I introduced in 1931. Of these Indian rices, three have been particularly welcome to rice farmers: two varieties—Panianala and Baitel Fakir—have been very successful in deeply flooded areas, and were grown by thirty-three different farmers. The other variety—G.E.B. 24—is a very fine quality white-grained rice which has given heavy crops under very widely varying conditions: one man, Pa Kumrabai at Port Loko, who was given 1 lb. seed in 1932 harvested twenty bushels this year. Further quantities of Yams (Yellow and Chinese) were distributed widely in all districts. The results of several years effort to encourage this crop has been most heartening: 191 farmers received planting material on loan.

Other food crops which have been established in new areas include Canary Banana and Mayugbe Cassava.

In regard to Ploughing, twelve of the twenty-six plough-owners ploughed. This is definitely encouraging; with the exception of one farmer, who was prevented by family troubles, all those who ploughed in 1932 ploughed again and, in addition, three farmers who had stopped ploughing have begun again. Most

of the plough-owners who have failed to plough in recent years are Paramount Chiefs who have no incentive to do the work and who only began it because it was a novelty. The area ploughed in 1933 was about seventy-five acres—an average of about six acres per plough-owner. Rice obtained from ploughed land was, with two exceptions, definitely better than that from similar non-ploughed farms in the vicinity.

The possibilities of encouraging the Bee-keeping industry with a view to the production of more and better quality honey and wax, have been under consideration. There appears to be fairly good prospects for improvement; in northern Karene and Koinadugu assistance will be particularly useful, as those areas are especially suited to bee-keeping and, in addition, the people have few money crops. Samples of an improved type of hive were made and are now being tested. These hives—similar to those used in the Sudan and Tanganyika—resemble those already used by the local bee-keeper, but differ in having two chambers instead of a single one and in that they are fitted with a queen-excluder which confines the production of brood comb to the anterior chamber.

Locusts were present from January to June and returned again in November. In the latter month considerable damage was done to swamp-rice farms on the Port Loko creek and in some of the Kambia chiefdoms. Hoppers were recorded from Kambia and Karene districts in May and June. A small amount of damage was done to early fundi and rice. Control measures were carried out successfully.

The food production of the province, taken as a whole, was satisfactory and probably above average. In a few districts there was a slight scarcity of seed for the upland farms, but any shortage from this cause was offset by better burns than usual, by the excellent crop of wet-land rice, and by an increase in the area under root crops.

R. R. GLANVILLE,
Agricultural Officer.

SOUTHERN PROVINCE.

During the first half of the year the Eastern and Western Agricultural Circles were in charge respectively of the writer and Mr. P. J. Moss. The last named officer proceeded on vacation leave prior to retirement from the Service at the end of June and the writer then took over charge of both circles with headquarters at Njala. Under the new organization of the department, agriculture in the Southern Province will be administered from Njala which is the principal agricultural station in the province.

Farming Conditions during the year were on the whole favourable for the principal food and plantation crops. The upland rice crop was not altogether level throughout the districts but, taken over all, it was satisfactory.

District Work has of necessity again been restricted. Work was continued in both circles in those areas which had previously received concentration of effort. The five chiefdoms immediately around Njala form one of those areas and they receive the attention of the Agricultural Officer in charge of Njala Agricultural Station. In the Eastern Circle the substation at Kenema continued to serve its area. A second substation in the same district was opened at Naiahun and this proved useful for the production of planting material for distribution in the populous Nongowa and neighbouring chiefdoms. In place of the two substations at Pendembu and Kailahun a new substation was opened at Pandobu and this was also successful in its first season. In the Western Circle a substation was opened at Sumbuya. The native staff for district work consisted of four Agricultural Instructors and a temporary Instructor for the Eastern Circle, an Overseer and four Instructors in the Western Circle and two Instructors for the Njala chiefdoms. Of these, four are illiterates who received practical training in nursery and plantation work.

Work in the substations was concerned mainly with the planting of food crops to provide stocks of planting material for distribution to farmers and for demonstration purpose. The principal crops grown were: rice, cassava (Two-cent and Mayugbe varieties), yams (Yellow and Chinese), maize (two varieties), cowpeas, ground-nuts and ginger. There is a demand for quick-growing Maize for garden cultivation and the Fula and Aku kinds were grown for the purpose. The Aku variety in particular gave a good yield. With regard to Cassava, the two varieties most resistent to mosaic disease are now well distributed in the province, and especially in those areas where the disease was prevalent. There is a noticeable increase in the cultivation of Cowpeas for local consumption, Birdseye being the variety that is mainly grown.

A list of Planting Material Distributed will be found in Appendix I. As in past years seed-rice takes the first place. In most cases the planting material is given free of charge on the understanding that the quantity issued with, if possible, an increase, is returned after harvest.

Work with Plantation Crops was concerned mainly with oil-palms, coffee and, to a less extent, cacao. The planting of Coffee is being taken up with some keenness in most districts. The appearance of the crop, approaching maturity at the end of the year, was satisfactory. In the Eastern Circle rather more than 11,000 seedlings were planted in eighty-two farms; in the Western Circle 13,900 seedlings in sixty farms; and in the five Njala chiefdoms 200 seedlings in one farm. Nursery work was continued at Kenema substation and nurseries were also made at Pandobu and Naiahun substations to raise stocks of coffee and Nigerian and Deli oil-palms. A number of central nurseries were made besides these and many for individual farmers. In the Eastern Circle

some 21,000 seedlings were raised in sixty-two village nurseries; in the Western Circle 5,000 seedlings in sixteen nurseries and in Njala chiefdoms 22,600 seedlings in one hundred and fourteen nurseries.

Agricultural Teaching has been given all possible assistance, particularly in the first half of the year when it was possible for Agricultural Officers to pay periodic visits to the more important schools in their circles. Selected schools in the province were invited to send members of their teaching staff to a second Course of Instruction which was held at Njala in August and in the management of which the Reporting Officer participated.

There is little to report under Meteorological Work in which a number of the larger schools co-operate. Kenema and Mabang recording stations were closed in June when circle agricultural headquarters were transferred from these places, and Bunumbu School ceased to be a recording station in February.

The numbers of farmers recorded in the Farmers' Registers of the circles are 816 in the Eastern, 216 in the Western and 115 in Njala chiefdoms.

J. W. D. FISHER,
Agricultural Officer.

COLONY CIRCLE.

Dr. F. J. Martin was in charge of the newly-formed Colony Circle from the beginning of the year up to August 31st; Mr. E. I. Nisbett from then until December 8th, and the Reporting Officer only from December 8th to the end of the year.

The Staff has consisted of three Agricultural Instructors: one stationed at Freetown, covering the surrounding area, one at Waterloo, covering the area west of Makumba, and one at Newton, covering the eastern part of the circle. A temporary Instructor has also been working at Regent during the last few months of the year.

Cassava is by far the most important food crop in the Colony and mosaic disease is very prevalent on all the common varieties. Much attention has been given to instructing farmers in the importance of propagating from disease-free material, and a certain amount of this has been distributed from the Fruit Farm.

Extension work in connection with Wet-land Rice has been resumed, seed for the purpose having been supplied by the Agricultural Officer, Northern Province. In the western area of the Colony thirty-nine bushels, and in the eastern fifty-four bushels, of the three varieties D.C., Fodea and Litoma, were distributed free to applicants on the understanding that an equal amount of seed should be returned to the department after harvesting. The greater part of the seed was planted in May and transplanted to the swamps during July, August and September.

Apart from the presence on a few farms of a disease, identified by the Mycologist as *Helminthosporium oryzæ*, the rice work has been very successful, especially in the western area, and there seems to be a good prospect for the further extension of the work.

Over 4,000 suckers of Canary Bananas were distributed from the Fruit Farm during the year. Most of these were planted in the Freetown area, the largest plantations being at a farm at Regent and on land adjoining the prison. It is evident that large bunches, such as are required by the English market, are only produced from large plants. At the plantations mentioned, which are both on steep slopes of lateritic soil, holes were dug for the plants and a large amount of organic matter put into them and allowed to rot, before the suckers were planted. The resulting growth of the plants has been remarkably good.

Figures showing the number of Citrus Plants distributed from the Fruit Farm are given in Appendix I. The great majority of these have been planted in or around Freetown, but there is not at present much demand from farmers for citrus plants.

Citrus Scab was very prevalent during the rainy season, but control work, consisting of the removal and burning of all infected leaves and subsequent spraying with a copper sulphate fungicide, was undertaken in the Freetown area. When inspection was made at the end of the year hardly any trace of the disease was found.

The artificial Colouring of Oranges by means of ethylene gas has been successfully undertaken. A number of cases of coloured fruit were sent to a firm in England and satisfactory reports received.

Seed of *robusta and stenophylla* Coffee was distributed free to applicants early in the year. The plants in most of the nurseries have done well and there is an increased demand for *robusta* for next year.

A few Pine-apples, of the Queen and Smooth Cayenne varieties, have been distributed.

Advice has been given regarding the growing of Vegetables and other Crops, of which the Black-eye Cowpea, or "Waterloo Bean," is at present the most popular and widely distributed.

E. S. GARNER,
Agricultural Officer, Colony.

PRODUCE INSPECTION.

Palm Kernels.—The low prices which prevailed throughout the year for palm kernels necessitated constant vigilance at all buying centres and ports in order to ensure maintenance of the prescribed standard. Repeated fluctuation of prices offered oppor-

tunities to many of the smaller dealers for speculation against an advance, but their storage facilities in the majority of cases are extremely bad for any form of produce, consequently, from time to time produce was found which, upon examination, revealed deterioration.

Produce as prepared by native collectors has been good, but where it has been found necessary, advice and instruction has been given to improve preparation; the continuance of this practice has undoubtedly been the means of bringing cleaner produce to the market.

Exports for the year amounted to 64,083 tons; of this 33,294 tons were handled by the Railway, the remainder being conveyed by river and other forms of transport.

Collectors in the vicinity of the markets of Sulima and Mano Salija continued to make progress and joint exports from these ports amounted to 363 tons.

Attention is directed to the fact that, in spite of low prices, the exports for the year though less than in 1932 are well above the average of exports of the past ten years.

Palm Oil. The conditions affecting palm kernels have equally affected the palm oil industry, and dealings for the year were slightly below those of 1932. Railments from up-country buying centres amounted to 1,362 tons, while exports from Freetown and Bonthe amounted to 606 and 1,013 tons, respectively. No infringements of the relative section of the Native Produce Ordinance were reported, the general quality of the oil being clean and free from adulteration.

Piassava. The improvement in the preparation of piassava, which has been brought about by instructional propaganda, has continued throughout the year and there is an increasing demand for markets abroad for greater quantities of prime quality than have hitherto been obtainable. To meet with this demand, new areas are now being investigated and provision has been made for the employment of additional instructors in 1934. Exports for the year constitute a record and amounted to 3,499 tons; of these 2,220 tons were shipped from Sulima; 290 tons from Mano Salija; 883 tons from Bonthe and the remainder from Freetown.

Instructional propaganda in the portion of the country serving the Sulima market has met with success, and as a result shipments have been made of a better quality than that hitherto associated with Sulima piassava. Instruction has also been carried out in one or two areas close to the main railway line. The material obtained was of exceptionally good quality but very little was produced. It is difficult to start a new industry in any area and the diffidence of natives and firms towards adopting new industries can only be overcome by patience, encouragement and time.

Raffia. Little interest has been shown during the year in raffia production; the market demands have been disappointingly small and discouraging and exports amounted to only 5 cwt.

Ginger. Business in ginger has on the whole been satisfactory, and exports are slightly in excess of last year's; they amounted to 1,545 tons, and railments to 1,579 tons. The quality on the whole was consistent with that usually associated with Sierra Leone ginger.

Rice. Exports of rice amounted to 159 tons; supplies for home consumption were sufficient to meet with requirements.

Exports of other forms of produce which are not regulated by inspection were as follows:—

Benniseed	14	tons
Cocoa	67	,,
Kola nuts	1,812	,,
Peppers	69	,,
Coffee	3	,,

Prosecution. The number of cases reported for infringement of the Native Produce Ordinance amounted to 123; from these 111 convictions were obtained, 11 cases were discharged and 1 remains to be dealt with.

Weights and Measures. The verification of weights and measures was carried out by the Acting Inspector of Plants and Produce during the year and 220 certificates of justness were issued.

F. W. B. ALLINSON,
Acting Inspector of Plants and Produce.

PART III—AGRICULTURAL INVESTIGATION.

ENTOMOLOGICAL WORK.

The following account of work is arranged under the different crops concerned.

Citrus.—Fruit piercing Lepidoptera appeared early in May, but it is noteworthy that *Achœa catocaloides*, the main species concerned for a few years previous, was rare, but *Achœa mormoides* showed increase while *Othreis fullonica* remained about the same We have now 51 species recorded as fruit piercers, of which 44 attack citrus.

Further larval hosts have been found. That of *Othreis divitiosa* mentioned in the last report was identified as *Dioscoreophyllum leonense*, but its main host has been found to be *Rhigiocarya racemifera*, a common and widespread species. The larval host of *Othreis fullonica* is *Tiliacora* sp. near *Dinklagei*, and other larvæ found on this were probably *Othreis materna*. These three species of plants belong to the *Menispermaceæ*.

Most larvæ occurred towards the end of October and during November, and a period of 35 to 40 days is required for a complete generation (egg to egg). It appears that the females of both *fullonica* and *divitiosa* are able to lay about 300 eggs, in the first batch, but whether or not they develop further eggs is not known. Since the time of emergence (middle to end of November for *fullonica* and during December for *divitiosa*) of the main brood, not one has been seen in the field, and it is apparent that they migrate as was the case with *Achæa catocaloides*.

Regarding control, it is evident that it is impracticable to eradicate or treat the larval hosts and also therefore, the immature stages of the moths, so that either the adults will have to be dealt with, or the crop and harvest limited to the period when few moths are present, October to February.

Comparative spraying programs were instituted and carried out, in collaboration with the Mycologist, with the ultimate aim of finding a minimum treatment which will deal effectively with mites, thrips, scale insects, scab and other diseases.

Ground-nuts.—Some further work was carried out on mosaic diseases, and it was found that the dark-veined type of disease was transmissible by the aphis, a period of 12 to 13 days being required for symptoms to develop.

Bananas.—The aphis of banana proved to be *Pentalonia nigronervosa*, Coq., the reputed vector of " bunchy-top " disease. Periodical spraying was carried out, but results were not good, probably due to reinfestation from outside; this method of control would appear, therefore, to be impracticable since either all banana plants in the surrounding district would have to be treated, or spraying carried out at very short intervals. Good results were obtained by the removal (and destruction) of the terminal portions of the inflorescences soon after all the fruit on each had set.

Bees.—A modified type of the native Bee-hive was constructed. The ordinary one is about 5 feet long and a foot in diameter, is cylindrical or somewhat barrel-shaped, and made of raphia cane basket-work coated with cow dung; this is then thatched with grass.

In the modified one, it is made in two parts, the front part of the honey chamber fitting into the rear of the brood chamber, a queen-excluder being fixed to the hind end of the latter so that wax and honey will not be contaminated with brood, and also enabling the rear honey chamber to be detached without destroying or losing the swarm. Results are not yet to hand.

Locusts.—From the beginning of the year to early May, 70 reports of swarms of locusts were received, but little egg-laying occurred and only some 30 small hordes of hoppers were reported, and dealt with, during May and June. There was a further invasion, however, commencing at the end of October, and some

eggs were laid during November in various parts of the country; these hatched in December, the hoppers being those of the swarming phase.

Comparatively little damage was done.

In contrast to last year, Dipterous parasites of ZONOCERUS VARIEGATUS were not in evidence.

More than 2,500 specimens were submitted to the Imperial Institute of Entomology and nearly 600 identifications were received which included 38 new species and 22 new to the British Museum; these have been incorporated in the REFERENCE COLLECTION.

E. HARGREAVES,
Entomologist.

MYCOLOGICAL WORK.

The following account of the work is given under the different crops with which it was done.

BANANA. Tip and stem end rots of Cavendish banana in the field, associated with *Glœosporium musarum*, were recorded at Njala early in the year. Black tip rot, associated with *Helminthosporium torulosum*, was seen again at Njala and Newton, but fruit rots in the field do not appear to be very common. Inoculation trials were made on a few half grown and ripe fruits in the laboratory with *Helminthosporium torulosum*, *Stachylidium theobromæ* (recorded in last report as *Verticillium*), and two strains of *Glœosporium musarum*, the fungi being inserted as spores mixed with mycelium into cuts in the surface-sterilized fruit. No sign of infection was obtained with *Helminthosporium* or *Stachylidium*. A slight blackening was observed round the cuts on the half grown fruit after two days with the more typical and freely sporing strain of *Glœosporium musarum*, and after five days with the atypical strain, but the blackening did not extend further than 1–2mm. from the cut. On the ripe fruit, both strains of the *Glœosporium* gave rise to dark rotted patches half an-inch across after two or three days, and the more typical strain was sporing abundantly on the surface of these lesions by the fourth day, after which all the fruits were over-run by *Diplodia* which entered at the stem end. The trial, although on too small a scale to be conclusive in regard to pathogenicity of the first two fungi, at least indicates that, in Sierra Leone, *Helminthosporium torulosum* and *Stachylidium theobromæ* are less vigorous parasites of bananas than *Glœosporium musarum*.

A leaf speckle has been observed on all varieties of banana and plantain at Njala and Batkanu and is probably widely distributed in the country. It is most abundant during the rains, but infection evidently takes place to a small extent in earlier part of the dry season. The disease appears on the upper surface

of the leaf as a number of minute very dark brown spots aggregated into patches of varying size and shape but generally about an inch across. Round the patches, in older leaves, a yellow colour may develop. On the lower surface, the spots are more defuse and the colour a paler brown. A species of *Rhinotrichum* is associated with the disease. The brown hyphæ of the fungus spread over the patches on the under surface of the leaf, where its sporophores are abundant, and the " speckles " on the leaf are formed of small blocks of palisade cells which have been killed by branch hyphæ which penetrate the stomata on the lower surface and cross the spaces in the spongy parenchyma.

Cassava. The observation plot at Njala (*see* last report) was kept up. Some 50 of the original 501 healthy and 39 plants with mosaic died or were uprooted accidently during the year. For convenience of observation, the plants were all cut back to about 6 inches in the last week of March. Symptoms of mosaic appeared during 1933 in 25 plants previously healthy, new plants being recognized as infected in March (2 plants), April (1), May (1), June (4), July (5), August (2), September (3), October (4), November (2), December (1); no further infections were noted up to February 14th, 1934, when the plot was cut out. From the two years' observations it appears that the greatest number of infections occur during the rainy months, June–October, and there is some indication of less spread in the wettest months (August in 1933). The rate of spread of the disease at Njala is evidently rather slow, but this must not be taken as necessarily typical of the whole country; it is very probable that the rate of spread is considerably quicker in the Colony and in other parts near the coast.

Varieties to which the disease spread in 1932 and 1933 were Cotton (9 plants), Shenge (9), Kande (9), Whitehead (4), Agbani (3), Black or Mende (3), Snake (3), White (1), Red-skin (1) and Sessile-leaf or Sowai (1). Varieties of which none became diseased were Mayugbe, Two-cent, Kono and Cotton-tree. The Kono and Cotton-tree varieties are by no means immune, however, as specimens with mosaic have been seen quite frequently in other parts of the country. It had been supposed, on the basis of observation at Njala and other places inland, that Mayugbe and Two-cent were at least very resistant to the disease, but this year mosaic was seen on both these varieties in the Colony, to which they are very recent introductions, and it seems probable that near the coast these varieties may be little if any less susceptible than others.

While diseased plants occurred mostly in groups on the observation plot, there were many cases of a plant of one of the most susceptible varieties growing for the two years with its branches interlocked with those of an adjacent diseased plant and still remaining healthy.

Cases of apparent recovery from mosaic were observed this year at Njala. On some year-old diseased Samuya plants apparently healthy shoots were borne from time to time, especially about June–July, as branches of shoots showing typical mosaic; those allowed to remain on the plant eventually showed typical mosaic symptoms on their later produced leaves. Two of these apparently healthy shoots from two different plants were broken off, broken into short lengths, and planted. In both cases the plants originating from the lowest portions showed mosaic symptoms while the upper portions produced plants which after seven months still have shown no symptoms of the disease. Further, a young Samuya plant rogued out of a plot in early October, 1931, on account of suspected mosaic, and planted for observation, has borne healthy leaves on its stems for nearly $2\frac{1}{2}$ years, but in December, 1933, produced, from the base of one apparently healthy stem 10 feet high, a shoot which showed mosaic symptoms from the first. It is also noticeable that diseased shoots commonly produce in the dry season leaves which show only slight mosaic symptoms and often, finally, leaves which show no symptoms at all.

Eighty-two seedlings were raised from seed collected from plants of several different varieties of cassava all of which showed mosaic. All the seedlings bore healthy leaves.

Mosaic was this year seen on Ceara rubber (*Manihot glaziovii*) at Wilberforce and Cline Town in the Colony. The fungus associated with the stem lesions on cassava described in the report for 1931 has been identified as *Glœosporium manihotis* P. Henn. The disease is common in the rains at Njala.

Citrus. Scab was much less severe on the leaves of the young grapefruit trees (planted in 1927) at Njala than in past years, though it was still fairly severe on the trees in neighbouring rows which were planted in 1928. This difference in severity of the disease was also shown by the figures for scab infection of the fruit this year; 56 per cent. of the fruit from the trees of the 1927 planting were scabbed as against 80 per cent. scabbed on the younger trees.

This year, leaf production was confined almost entirely, on the trees of the 1927 planting, to three large flushes, in March, April and October; intermediate leaf production was very small and the July–August flush was omitted. The fall of the old and for the most part badly scabbed leaves from the main branches was practically completed during the dry season of 1933–4.

The grapefruit trees (planted in 1916) in the arboretum have been practically free from scab in past years in spite of the close proximity of two badly scabbed sour orange trees of the same age: this year, possibly owing to the presence of a severely scabbed seedling rough lemon only a few yards from the trees, scab lesions were observed on a few leaves and on 10 per cent. of the fruit from six grapefruit trees, the amount of infection varying on the individual trees from 0–20 per cent.

Scab was recorded this year for the first time on some seedlings of " sweet lime " at Newton. Normally this variety is immune, but a few seedlings out of a large bed were found to be very severely attacked. The disease was also recorded for the first time on fruits of old tangerine trees at Njala.

No scab has yet been seen on native sour orange trees in the country with the exception of a few small lesions on four fruits on a large tree some three miles from Newton; this tree was used as seed supply for Newton, and it is possible that it was infected from there in some way. As all early introductions of citrus were presumably by seed, it seems reasonably certain that the disease was first introduced on grafted plants (grapefruit) from Florida in 1916 and has been reintroduced subsequently on two or three occasions from Florida and South Africa. Since the extent of the disease in Sierra Leone is limited and known exactly, an effort is being made at least to eliminate it from outstations.

Citrus fruit rots in the Njala store during the early part of the grapefruit harvest were estimated as accounting for about 225 fruits out of 6,750. The most common fungus causing rotting in October–December was the olive-green mould *Penicillium digitatum*, *Diplodia* being rather less frequent. The seat of attack was in most cases the button end (though *Penicillium* also entered through wounds and bruises), and the number of rotted fruits was considerably reduced after the removal of the " buttons," except when they fell off naturally, was stopped. On older fruit at the beginning of 1934, the above two fungi occurred in more or less equal proportions, and the *Diplodia* infections appeared in several cases to have originated while the fruit was on the tree. *Colletotrichum glœosporioides* occurred as a fruit rotting fungus to a small extent. *Penicillium italicum* was rare in the store and was only recorded, often mixed with *Penicillium digitatum*, on grapefruit and tangerine, at the end of the harvest, early in 1934. *Diplodia* and *Penicillium digitatum* were also recorded as rot-producing fungi on tangerine, sweet orange and lemon in store. *Aspergillus niger* was only once seen on grapefruit in the store, conditions presumably being not usually sufficiently humid for its attack.

Fruit splitting was common at Njala on the Valencia and to a certain extent on the Washington Navel oranges in November and December. In some cases it appeared to be primarily physiological but in others the splitting appeared to have occurred at a point of infection by *Colletotrichum glœosporioides*. In all cases, *Oospora citri-aurantii* soon entered at the split and rotted the pulp and rind.

The fungi recorded as associated with fruit rots following fruit-piercing lepidoptera and needle-punctures (*see* last report) have been identified by the Imperial Mycological Institute as follows: the *Fusarium* forms (from both orange and grapefruit)

appear mostly to be in section *Liseola* in the *F. moniliforme* group, and are provisionally referred to *F. moniliforme* Sheld., of the var. *majus* Wr., and (most strains) to var. "*subglutinans*" Wr. and Rg. One form isolated (from grapefruit) is in section *Elegans* and apparently a form of *F. oxysporum* Schlecht., and another (also from grapefruit) in section *Martiella* and comes nearest *F. theobromæ* App and Strunk. Fusarium was more common in fruits stabbed with a needle than in those pierced by moths. Other fungi identified were: *Oospora citri-aurantii* (Ferrar.) Sacc. and Syd., *Colletotrichum glœosporioides* Penz., *Peroneutypella pusilla* Syd. (recorded as *Phomopsis* in last report), *Mycotorula* sp. (probably) and *Saccharomycodes ludwigii* Hansen.

The last two fungi, alone or mixed, and generally mixed with bacteria, are the commonest fungi found in rots following fruit piercing lepidoptera, but inoculation trials in the laboratory on grapefruit and "sweet lime" with them, alone and mixed, have failed repeatedly. Inoculation trials were also made with the other fungi inserted into deep needle punctures in the fruit in the laboratory. With *Colletotrichum* they were generally successful, causing a dry rot of ripe grapefruit and lime in 9–12 days: lemons were slightly attacked but inoculations made on a few oranges failed. *Oospora* caused a very soft wet rot visible in two to four days on ripe fruit of grapefruit, lemon, lime and "sweet lime," but not on unripe but full grown grapefruit or lemon. *Aspergillus niger* caused a very soft wet rot, visible in five days or sooner, on ripe grapefruit, lemon and lime. No infection was obtained with the mycelium of *Peroneutypella* inserted into grapefruit, lime or lemon, nor with *Diplodia* on grapefruit, lemon, lime or "sweet lime." All the eleven *Fusarium* strains but one (one of the *F. moniliforme* var *subglutinans* group) produced a rot of ripe grapefruit with about the same rapidity, but not on unripe fruit. In grapefruit, the rind, except for the soft inner layer, is not attacked by *Fusarium*, but in the only orange fruit used the rind was rapidly rotted through: the rot produced by *Fusarium* when inoculated into lemon fruits was very similar to that in grapefruit.

A blossom blight of sweet orange at Njala in the very wet weather of August and September was associated with *Botrytis*. It is of little importance as this is an irregular flowering time for citrus.

The *Botrytis* recorded in the last report on flowers of Avocado and *Jatropha* has been identified as *B. cinerea* Pers. It was again troublesome on avocado during the dry season 1933–34, and at the beginning of January 1934 what is presumably the same fungus was responsible for a very common blossom-blight of oleander at Njala. Evidently the heavy dews and night mists in the severe harmattan season are very favourable for such attack.

Miscellaneous Diseases recorded include "green-ear" disease, caused by *Sclerospora graminicola*, of bulrush millet (*Pennisetum leonis*), which was abundant on a farm near Njala,

and *Ustilaginoidea virens* on swamp-rice near Mano. Both these diseases have been seen in previous years in this neighbourhood. New records are " frog-eye " spot, common on leaves of *Nicotiana rustica* in the Northern Province and recorded on *Nicotiana tabacum* near Njala, caused by *Cercospora* sp., presumably *C. nicotianæ* Ell. and Ev.; leaf spots of sunn hemp (*Crotalaria juncea*), *Clerodendron fallax* and *C. paniculatum*, and a number of wild host plants at Njala, caused by species of *Cercospora*; leaf blotch of guinea-corn (*Sorghum margaritiferum*) at Njala, caused by *Helminthosporium* sp.; leaf spot of *Impatiens holstii* hybrids at Njala, caused by **Myrothecium* sp., probably *M. roridum* Tode; *Fusarium* wilt of the common weed, *Ageratum conyzoides*, at Njala; bacterial wilt of *Coreopsis drummondi*, at Njala; tip blight of leaf of sabal palm at Njala, associated with **Fusarium*, apparently a strain of or near *F. sambucinum* Fuck. form 6, Wr. (*F. discolor* var. *sulphureum* (Schl.) App. and Wr.); *Oidium* (presumably *Erysiphe cichoracearum* DC.) on okra and, rarely, on the weed *Spigelia anthelmia* at Njala; leaf spot, chiefly on older leaves of Frangipani (*Plumeria*), caused by *Colletotrichum* sp., at Njala; *Cladosporium fulvum* Cke., on leaves of tomato; **Sclerotium coffeicolum* Stahel, on leaves of *Jasminum pubescens* at Njala, causing defoliation. The sclerotial stage of **Macrophomina phaseoli* (Maubl.) Ashby was isolated (with bacteria) from the rotten root of a pawpaw at Njala; this is the second record of this fungus in Sierra Leone. (*Records marked with an asterisk have been determined by the Imperial Mycological Institute*).

Strains of *Sclerotium* of the " *S. rolfsii* group " were, as usual, very troublesome in gardens at Njala and occasionally elsewhere, and were recorded as causing either stem or tuber rot or leaf spot on a large number of host plants, the more important of which were Jerusalem artichoke, Chinese yam, tomato and French bean.

The following indentifications have also been received from the Imperial Mycological Institute: *Choanephora* sp., apparently *C. infundibulifera* (Curr.) Sacc., on old blossoms; *Coniothyrium* sp., on leaf spot of mango (doubtfully parasitic); *Nigrospora oryzæ* (B. and Br.) Petch, isolated from leaf blotch of banana (together with *Scolecotrichum musæ* and *Helminthosporium torulosum*); **Fomes yucatanensis* (Murr.) Sacc. and D. Sacc parasitic on *Cathormion altissimum; Stereum umbrinum* Berk. and Curt.; *Polyporus ostreiformis* Berk.; *Polyporus gilvus* Fr.; *Lycoperdon wrightii* Berk and Curt. The following entomogenous fungi: *Cordyceps tuberculatum* (Lev.) Maire (*C. sphingum* (Tul.) Sacc.), on noctuid moth; *Hymenostilbe formicarum* Petch (conidial stage of *Cordyceps lloydii* Fawc.) on ant; *Hypocrella reineckiana* P. Henn., on lecaniid scales on *Ficus ovata; Aschersonia* stage of *Hypocrella sphæroidea* Syd. (*H. olivacea* Petch), on lecaniid scales on *Phœnix dactylifera; Aschersonia crenulata* Pat.

and Har., on aleurodid on *Phyllanthus discoideus;* probably *Synnematium jonesii* Speare, on *Basilides bipennis* and another membracid. A yellow *Aspergillus* recorded on a nymph of the common grasshopper (*Zonocerus variegatus*) at Njala appeared to be the same as that previously recorded on the locust (*Locusta migratoria migratorioides*).

Over 200 specimens of fungi, including a number of species of *Cercospora* and *Meliola*, and 300 specimens of flowering plants were despatched during the year to the Imperial Mycological Institute and Royal Botanic Gardens, Kew, duplicates being placed in the HERBARIUM.

F. C. DEIGHTON,
Mycologist

NJALA AGRICULTURAL STATION.

During the first half of the year Mr. E. I. Nisbett, Agricultural Officer, was in charge of the station, and for the remainder, when Njala became the agricultural headquarters of the Southern Province, the Reporting Officer was in charge.

Practically no work of an investigational nature had been planned for the station and the financial provision was devoted almost wholly to the plantation crops and to cleaning and restoring to a proper state of cultivation those sections of the main farm which had been neglected during the past three years when the farm was on what was known as a maintenance basis. This entailed heavy labour in eradicating strong growths of lalang and dhub grass from those sections formerly used for annual cropping.

With regard to PLANTATION CROPS the CITRUS varieties in Plot 15 and in the Arboretum bore good crops. The main crop of grapefruits was particularly good and some 20,000 fruits were picked and disposed of in the local market. After careful examination the best trees have been selected for special treatment to provide future requirements of budwood. Of the various varieties of oranges the best fruit has been obtained from Lue Gin Gong with the Late Valencia next; the quality of the Washington Navels is not at present satisfactory. The pruning of dead and diseased wood was carried out in all citrus plots. Pigeon-pea and Tephrosia forming unsuitable cover crops were removed and, after ring-weeding, all trees were given a heavy mulch of compost and grass. Spraying operations (including experimental spraying by the Entomologist and Mycologist against citrus scab on grapefruit) were carried out in the grapefruit and orange plots.

Dominica lime plot received no special attention beyond the usual cleaning operations. The table gives the yield in bushels per 100 trees from each section during the past six years: A, thinned section; B, unthinned:—

—	A	B	A	B	A	B
1928	633	763	370	474	455	431
1929	681	512	465	327	389	247
1930	532	392	492	259	257	186
1931	348	153	205	72	159	52
1932	376	185	330	166	132	97
1933	335	150	246	107	161	122

As in former years the existing Coffee plots have been maintained principally for seed requirements in the circles. There is a decreasing need for this however, as circles can now meet most of their requirements from sources within their areas. Surplus stocks of coffee have been prepared and marketed locally.

A start was made towards the end of the year with the opening up of a fresh area of land at New Njala for experimental work with coffee. For the present, only those methods which are considered to be most suitable for adoption by native cultivators are being employed.

Work on Kola was confined to cleaning the plantations and harvesting fruit.

Oil-palm in the six variety plots received similar treatment to that given in former years. The Deli palms are now coming into bearing and the general appearance of this plot is satisfactory. These oil-palm plots form the subject of a separate report by the Mycologist.

Hydnocarpus (*H. Wightiana* and *H. anthelmintica*) have put on some growth and seem to be thriving reasonably well.

A few ornamental trees and creepers were planted out at New Njala; among others, *Peltophorum ferrugineum*, *Pithecolobium unguis-cati*, *Aristolochia splendens*, *Cassia auriculata*, *Cassia nodosa*, *Cassia javanica*, *Pentadesma butyracea*, *Parkia biglobosa*.

With regard to Annual Crops a further small trial was conducted with native varieties of Wet-land Rice. The land rented from a native cultivator was unfortunately not altogether suitable for experimentation. Several of the plots suffered considerably from stagnant water and the accumulation of algæ.

Observations on the native rices are set out in the following table: —

Variety.	Transplanting to harvest (days.)	Average yeild (2 plots.) lb.	oz.	Yield in terms of bushels per acre.
Bowdon's Kono	186	32	10	44
Koba	182	24	4	36
Indo China	187	22	15	31
Fodea	183	21	4	28
Yenti	128	21	0	28
Litoma	158	18	10	25
Ali Big	182	16	6	22
Kima	165	16	0	21
Ali Amara	181	15	12	21
Jabati	156	15	0	20
Lal	183	13	2	17
Kanlukafol	183	13	2	17
D.C.	128	12	6	16
Kpogo Yakei	182	9	8	13
Indian	163	9	8	13
Bolo	182	9	7	13
Yaka	165	8	14	12
Black Yakei	182	7	5	10

Both early and late season MAIZE were grown. For the first River Plate variety which had already received a favourable report was again tried. The result was entirely unsatisfactory. The Fula kind, sown in September on land from which " lalang " had been eradicated, yielded a moderately successful return.

COWPEAS of the West Indies Birdseye and local kinds were also planted, following the removal of ' lalang ' in October. The crop suffered from abnormal rainfall in November and it became heavily infested with *rhizoctonia*.

A trial in connection with mosaic disease of CASSAVA was started in October.

Amongst other crops grown for seed were CHINESE YAMS and SUNN HEMP.

NURSERY work included an experiment in shading of citrus seedlings in connection with citrus scab. Considerable quantities of planting material of economic and ornamental plants were again distributed and particulars of this are to be found in Appendix I.

J. W. D. FISHER,
Agricultural Officer.

NJALA OIL-PALM PLOTS.

Cultural operations were confined, as before, to cutlassing the grass and removing old leaves to heaps between the rows. Ring-weeding was continued for the convenience of harvesting and recording.

The NIGERIAN PALMS are in their thirteenth year after planting. No new trees came into bearing in 1933, and the kinds and numbers are therefore the same as given in the 1931 report; there are still ten trees which have not yet fruited. The nine trees which came into bearing for the first time in 1929, 1930 or 1931 have all given poor yields, averaging only 4·4 kg. per year.

Five trees of the A (thin-shelled) and two of the B (thick-shelled) group did not bear fruit in 1933, namely A *2/12*, 7/11, *9/13*, 21/2 and 23/12: and B 19/9 and 21/7 (italics indicating non-bearers since 1928). In addition, 7/11 did not bear in 1932, and 21/2 did not bear in 1929, 1931 or 1932. Tree 23/12 has given poor yields for the eight years recorded; the annual yield of 19/9 has steadily declined since 1929; 21/7, which commenced to bear in 1929, has given poor yields and did not bear in 1930.

The figures for the YIELD of the different groups, the yield of the whole plantation, and of averages, etc., are given in Appendix IV, A–G. For the first time the yield was greater in the second than in the first half of the year; as usual, March was the month of greatest yield. The yield for the year was 575 kg. greater than for last year, and 186 kg. greater than for 1931, previously the best year. The number of fruit-bearing heads harvested was less than in any previous year, and 156 less than in 1932.

In regard to FLOWERING, the number of female inflorescences at anthesis recorded during the year was 305 more than in 1932, but 242 less than in 1931. There were again two waves of flowering with crests in April (smaller than usual this year) and October.

There was a further decrease in the number of male inflorescences flowering, the number at anthesis recorded during the year being 129 less than in 1932. As in the years 1930–1932, the number of male inflorescences at anthesis was more than twice the number of females. July this year was the one month when there were fewer male than female inflorescences in flower, corresponding with June in most previous years and May in 1932. The month of minimum production of male flowers was July, and that of the maximum October; these times have been fairly constant in all years. Again, there was only one main wave of flowering of male inflorescences during the year, but this year there appeared a minor increase in April and May; a similar slight increase in April appeared in 1928 and 1929.

The Average Weight of Fruit per Head for thick-shelled was 1·5 kg. more than for thin-shelled, the actual figures being 5·9 and 4·4 kg., respectively; the average weight of head was 9·0 and 7·4 kg., respectively. The average output of fruit of B palms was 1·4 times that of A, about the same as in previous years. As in previous years, the proportion of fruit per head for the thin-shelled was considerably less than for the thick-shelled.

The highest yielding A palm in 1933 gave 95 kg. of fruit as against 83 kg. for the highest yielding B. From 1928, the majority of the trees in the plantation, both of A and B, have given annual yields lying between 10 and 30 kg. of fruit, yet the average annual yield of the B palms has each year been higher than that of the A because there is always a larger proportion of higher yielding B than A palms. In 1933, 24·6 per cent. (39 palms) of the B group yielded each more than 35 kg. of fruit, as against 8·4 per cent. (12 palms) of the A group. As regards total yield of fruit for individual palms for the eight years 1926–33, the highest yielding A palm has given 281 kg. of fruit (2 A palms have borne over 240 kg. of fruit), while the highest yielding B palm has given 350 kg. (22 B palms have borne over 240 kg. of fruit).

The figures for the yield of the Native Oil-palms are given in Appendix IV, H–K. As in previous years, the average output of fruit per tree is less than that of the Nigerian palms of the same age, and much less than that of the Nigerian B palms with which the native palms, which mostly bear thick-shelled fruit, should more properly be compared. The individual tree yields are small for the native palms, the highest yielding palms of the three types being, in 1933, Henoi, 33 kg. (several gave over 20 kg.); Kpolei, 42 k.g. (several gave over 25 kg.); Kawei, 43 kg. (several gave over 30 kg.). Compared with the other two kinds, the Kpolei palms, which are a year younger, are considerably better.

The figures for the yield of the Angola Palms are given in Appendix IV, L. In 1933, the six palms gave the following yields of fruit, respectively:—

Palms bearing thick-shelled fruit, 45 and 40 kg.;

Palms bearing thin-shelled fruit, 62, 53, 44 and 38 kg.

The average yield (from only six palms, however) is thus much higher than has ever been recorded from the Nigerian palms; and it was not till 1930 (10th year after planting) that a Nigerian palm gave a yield comparable with the highest Angola palm in 1933 (7th year after planting). The total output of fruit from the individual palms since they commenced to bear in 1929 ($3\frac{1}{2}$ years after planting) has been, respectively—

thick-shelled, 110 and 98 kg.

thin-shelled, 130, 100, 90 and 63 kg.

These figures compare favourably with those of the best few Nigerian trees of the same age.

In August, a rough analysis was made of the amount of pericarp in the Angola fruit, 267 thin-shelled and 24 thick-shelled fruits being used. The percentage by weight of pericarp in the thin-shelled fruit (from the best-yielding tree) was found to be 78·4, while that in the thick-shelled fruit (from the best yielding tree of this type) was 53·8. The percentage of pericarp in the thin-shelled Angola fruit is very similar to that in the average thin-shelled Nigerian. It is therefore evident that, provided the present high yields are maintained as seems likely, the thin-shelled Angola is the best type of palm at Njala, with the possible exception of the Deli for which comparable data are not yet available.

The average weight of one thin-shelled Angola fruit was 9·2 gr. and that of one thick-shelled fruit 10·8 gr. The Angola fruits are bigger than the Nigerian, and the kernel is large.

Figures for Average Weight of Head and Average Weight of Fruit per Head for the Kawei, Henoi, Kpolei and Angola palms are given in Appendix IV, M. Only in the case of the Kpolei and Angola palms does the average weight of head compare with that of the Nigerian palms of the same age; the Henoi and Kawei heads are considerably smaller.

The first fruit of the Deli Palms was ripe for harvest in January this year. The heads have been of average weight, 1·7 kg., containing 1·1 kg. of fruit. The fruit has been true to type, but occasionally the pericarp content has been rather low, as is to be expected from palms in their first year of bearing. Figures for the yield from this plot are given in Appendix IV, N.

The Periodicity in flowering and fruiting of all these palms is seen in the tables. There was one wave of male flowering in 1933, with a crest in the autumn, and a suggestion of a secondary wave with a crest in the spring. There was, however, only one wave of female flowering with a crest in the autumn, the secondary spring wave being hardly noticeable in any plot this year. Only in the Kawei and Deli plots were there more male than female inflorescences flowering during the year.

F. C. DEIGHTON,
Mycologist.

NEWTON EXPERIMENTAL FRUIT FARM.

The Reporting Officer was in charge from the beginning of the year until June 26th and from December 4th until the end of the year. During the rest of the year Mr. E. I. Nisbett was in charge.

In the Citrus Experiments, as much of the budwood received from a firm in California late in 1932 was dead on arrival, Professor R. W. Hodgson, Professor of Subtropical Horticulture at the University of California, very generously supplied every variety which was required from California.

In view of the age of the stocks it was decided to plant them out as early as possible and bud in the field. This was done, 1,020 stocks being planted in late April and early May. By the end of May the stocks first planted had begun to make new growth, and those intended for the Grapefruit Variety Trials were then budded from material previously available at Newton. Genoa lemon buds, also from Newton material, were used in the block allocated for lemons in the Rootstock Trials. The Californian budwood from Professor Hodgson arrived, as arranged, and in excellent condition, on June 13th and was budded on to transplanted stock.

Varieties obtained from California were—Marsh grapefruit, Valencia and Washington Navel orange, Lisbon and Eureka lemon, King mandarino, Dancy tangerine and Owari satsuma. Not more than 50 per cent. of the buds "took," but all of the varieties were established with the exception of the Dancy tangerine.

In addition to these, budwood of the Bernia variety of orange, from Spain, and Shamouti (or Jaffa), from Palestine, were obtained through the Director of Kew Gardens and the Chief Horticultural Officer, Palestine, respectively. Both varieties were successfully established.

The Layout of the Citrus Experiments is as follows:—

Rootstock Trials.—Three blocks (nearly eight acres). Rootstocks: Sour orange, sweet orange, rough lemon, sweet lemon, shaddock. Scions: Valencia orange, Marsh grapefruit, Genoa lemon. Five replicated rows of each stock-scion combination. 300 trees.

Variety Trials.—Four blocks (about 11½ acres).

Grapefruit.—Marsh, Foster, Royal Walters, Thompson, Duncan.

Orange.—Valencia, Washington Navel, Shamouti (Jaffa), Bernia, Lue Gim Gong and local seedlings.

Lemon.—Genoa, Lisbon, Eureka, Villafranca.

Mandarin Group.—King Mandarin, Dancy tangerine, Owari satsuma and one other. All on sour orange stock. Four replications. 320 trees.

Fertilizer Trials.—Five blocks each of ten treatments (about 27½ acres) Marsh grapefruit on sour orange stock. Eight trees form a unit. In each block half of the number of trees are budded from Californian material, and the other half from trees imported from Florida and grown at Njala Agricultural Station.

Four " guard trees " grapefruit (mostly Marsh but also a few of other varieties) have been planted in place of the young lime seedlings which were set out in 1932 and which had proved a failure.

The layout permits of ten fertilizer treatments, but the differential treatments will not be given until individual tree production records have been taken for a few years.

Of the Older Citrus Trees, the McCarty grapefruit, of which individual tree records have been kept, have made very good progress. Some are now bearing and have produced over 700 fruits, the majority of which were picked by the end of the year. The fruit has been sold from the farm at a price of 2*d.* a fruit locally and in Freetown. It is of good quality, but it seems unlikely that any variety having so many seeds can compete with the Marsh for purposes of export. Of the Duncan variety, one or two of the trees, received from Florida in July, 1930, have started to bear, but the trees are as yet quite small. Parent trees (that is, trees propagated in the nursery from which budwood has been taken for the experiments) have been set out in another section and are developing into good trees.

In the Banana Experiments the following table shows the results from the different treatments during 1932 and 1933.

Treatment.	Plot.	Yield in lb.	
		1932.	1933.
Irrigated, fertilized	2	3,592	2,021
	2A	3,353	364
Unirrigated, fertilized	1	2,225	599
	1A	2,082	253
Irrigated, no fertilizer	4	307	48
	4A	878	190
Unirrigated, no fertilizer ...	3	349	95
	3A	170	27

This very marked decline was attributed to lack of organic matter, for although *Calopogonium mucunoides* had been planted it failed to provide a satisfactory cover, except in the fertilized and irrigated blocks. Even in these blocks it did not provide a large bulk of material but did interfere seriously with the irrigation work. It was therefore decided half way through the year to revert to the same system of supplying a mulch of cut grass as was previously employed on an earlier experiment; the grass being obtained from adjacent uncultivated land. Although the benefits of this procedure are naturally not evident from the figures for 1933, improvement in growth began to be very obvious towards the end of the year and there is no doubt that the benefit will be reflected in the yields for next year.

The revenue for sales of banana suckers and fruits during the year has amounted to £15 1*s*. 6*d*.

A New Banana Experiment was commenced in May. A small stream, which never quite dries up during the dry season, was dammed and diverted so as to flow in a course higher than its original bed. The land between the new course and the original bed was terraced, and having thus being made irrigable with very little further expense was planted with bananas. The valley is sheltered from wind, and it is hoped that, with irrigation, it will produce large bunches of fruit, in which case similar projects might be undertaken in like situations elsewhere.

Of the imported varieties of Avocado only two plants, of the Fuerte variety have survived. The plants are so tender, and so susceptible to die-back, that it has not yet seemed advisable to cut buds from them, but seedling stocks are in readiness for when this can be done.

Propagation of three varieties of Pineapples, namely Queen from the Gold Coast, Smooth Cayenne from French Guinea, and Red Spanish (similar to the "native" variety) has been continued and the greater part of an area of about $2\frac{1}{2}$ acres planted. Fruit has been sold locally and some of the Queen and Smooth Cayenne suckers distributed.

Seed of *Robusta* and stenophylla varieties of Coffee was planted in January. The plants have made excellent growth and several thousands will be distributed next year.

The following varieties of Cassava are being grown at the farm—Mayugbe, Cotton tree, Shenge, White leaf, Kanda and Asia Minor. Plants affected by mosaic have been rogued so that disease-free material will be available for distribution.

A few hundred plants of Sumatran Oil-palm are being grown for distribution.

Spraying, and other remedial or preventive measures for the control of Insect Pests and Diseases, has been carried out as recommended by the Entomologist and Mycologist.

E. S. GARNER,
Agricultural Officer.

Appendix I.

DISTRIBUTION OF PLANTING MATERIAL 1933.

	Northern Province.	Southern Province.	Colony.	Njala
Banana, Canary (suckers) ...	866	—	4,070	—
Breadfruit	—	—	—	8
Cacao, seedlings	—	—	—	42
Cassava, Mayugbe, sticks (bundles)	143	31	—	16
Cassava, Two-Cent, sticks (bundles)	—	67	—	—
Coffee, Robusta, seed, lb. ...	257	62	24	325
„ „ seedlings ...	3,046	4,229	—	5,071
„ Stenophylla, seedlings, lb.	—	—	200	35
Orange	—	—	107	—
Grapefruit	—	—	407	—
Ginger, lb.	—	951	—	784
Groundnut, Kono, lb. ...	—	16½	—	—
Jakfruit	—	—	—	134
Kola	—	—	—	36
Lemon	—	—	48	—
Oil-palm, Nigerian, seed, cwt.	1½	—	—	2
„ „ seedlings ...	2,475	350	—	664
Potato, Sweet (vines), bundles	450	—	—	—
Pine-apple, queen	—	—	107	—
„ smooth cayenne ...	—	—	89	—
Pea, cow seed, lb.	—	66½	—	—
Oilpalm, Deli seed, cwt. ...	—	8¾	—	1
„ Seedlings	—	—	36	642
Rice, Yengebai (bushels) ...	—	2½	—	—
„ Panianala „ ...	—	½	—	—
„ D.C. „ ...	47	85½	20	—
„ Fodea „ ..	10	5½	28	—
„ Toma „ ...	11	—	40	—
„ Indian „ ...	14	—	—	—
„ Unspecified (bushel) ...	2	—	—	—
Yams, Chinese, lb.	737	1,468	—	796
„ Yellow, „	1,583	135	—	—
„ Coco, „	90	—	—	—
Maize, Plate, „	75	—	—	—
„ Other, „	—	492⅓	—	98
Fruit trees other than Citrus,	—	—	—	185
Calopogonium muconoides lb.	—	410	—	—

Appendix II.

RAINFALL, 1933.

	Northern Province.						Southern Province.									Colony.			
	Batkanu.	Kabala	Kambia	Makump.	Marampa.	Pepel.	Bonthe.	Bunumbu.	Jaiama.	Kailahun.	Kenema.	Koyeima.	Moyamba.	Njala.	Segbwema	Freetown.	Hill Station.	Kissy.	Newton.
January ...	0·07	0·40	0·00	0·00	--	0·00	0·00	0·00	0·00	0·00	0.00	0·00	0·02	0·00	0·30	0·00	0·00	0·00	0·00
February ...	2·27	3·45	0·83	—		1·40	0·16	0·45	2·61	2·10	1·40	4·95	1·66	2·02	2·72	0·57	0·45	0·48	1·33
March ...	0·27	0·92	0·09	2·05	—	1·54	1·08		4·82	6·60	6·42	1·93	3·23	3·98	5·79	1·21	0·76	1·17	0·92
April ...	3·39	3·78	1·49	1·53	—	2·96	25·78		6·60	6·78	5·19	7·79	6·54	9·12	3·97	3·72	3·81	4·59	2·97
May ...	5·60	7·81	9·47	13·68	—	5·63		—	7·48	7·54	10·81	7·95	4·25	7·17	4·59	3·65	4·96	5·89	8·25
June ...	18·30	14·15	24·98	7·81	—	15·30	32·18	—	16·13	18·50	14·05	31·86	11·91	16·58	15·10	30·01	36·54	22·24	17·92
July ...	16·77	15·19	24·56	23·82		18·42	33·68		15·55	21·39			13·29	19·34	15·09	31·76	41·10	34·80	30·81
August ...	17·91	25·36	32·88	24·33	20·13	32·29	19·56	—	17·13	39·09	--	25·04	19·25	26·22	25·07	37·45	48·66	38·66	32·44
September ...	16·68	11·99	12·12	22·98	10·45		25·50		11·29	38·33		17·41	13·79	9·05	9·05	15·63	14·74	12·59	10·67
October ...	17·52	6·77	15·00	28·91			6·28	—	5·21	19·66		10·23	8·95	10·27	13·23	7·78	7·02	7·52	9·17
November ...	7·52	4·76	4·68	11.86	7·29	--	1·04		8·78	15·51		10·28	9·10	9·53	7·32	13·12	11·05	11·37	11·58
December ...	1·41	1·33	0·25	4·27	0·11	—	4·60	—	1·84	5·10	—	4·31	1·64	1·80	6·58	1·23	1·23	1·64	1·14
Total ...	107·71	95·91	126·35	—	—		—	—	97·44	180·60	---	—	93·81	115.08	108·41	145·13	170·32	140·95	127·20

Appendix III.

REVENUE.

	£	s.	d.	£	s.	d.
LICENCES :						
Produce	1,101	0	0			
Fines for contravention of Native Produce Ordinance	108	10	0			
Departmental fines ...	1	18	6			
				1,211	8	6
FEES OF COURT OR OFFICE, ETC. :						
Sales of old stores ...	8	4	3			
Sales, produce	66	13	4			
Sales, Newton Fruit Farm ...	27	9	6			
				102	7	1
Total				£1,313	15	7

Appendix IV.

A—NIGERIAN OIL-PALMS, NJALA, 1933.

	Yield of A.				Yield of B.				Yield of C.				Yield of D.			
	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, kg.	Weight of fruit, kg.	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, kg.	Weight of fruit, kg.	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, kg.	Weight of fruit, kg.	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of heads, kg.	Weight of fruit, kg.
January	30	37	263·7	132·3	37	53	526·8	335·2	4	6	39·7	22·0	—	—	—	—
February ...	33	48	341·0	168·7	41	68	530·5	321·2	4	5	26·5	15·9	—	—	—	—
March	76	143	855·2	484·0	69	124	969·2	617·2	4	12	61·3	38·9	1	1	9·5	5·3
April	34	57	362·0	229·0	29	64	469·8	315·6	4	6	41·0	23·0	—	—	—	—
May	23	37	302·6	171·1	23	59	402·8	258·1	5	8	57·3	33·7	—	—	—	—
June	29	44	303·4	181·6	32	45	378·5	248·4	2	2	17·1	10·7	—	—	—	—
July	25	33	256·8	137·6	46	60	579·7	369·4	6	7	43·3	24·2	—	—	—	—
August	46	57	422·5	243·1	54	69	665·2	432·7	6	10	88·9	56·6	1	1	10·9	8·5
September ...	40	51	394·2	250·2	43	61	593·7	402·3	3	4	28·1	17·7	1	1	9·5	7·3
October	49	66	618·9	409·6	48	59	620·2	431·5	5	7	82·5	55·2	—	—	—	—
November ...	32	43	424·5	265·8	33	41	484·3	332·8	4	5	62·6	44·3	—	—	—	—
December ...	21	26	222·6	137·7	23	25	301·8	205·8	1	1	14·4	10·0	—	—	—	—
Total ...	144	662	4,767·4	2,810·7	157	728	6,522·5	4,270·2	15	73	562·7	352·2	3	3	29·9	21·1

Appendix IV—*continued.*

B—NIGERIAN OIL-PALMS, NJALA, 1933.

YIELD OF WHOLE PLANTATION.

	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of good heads harvested, kg.	Weight of fruit, kg.
January	71	96 + 21 blind = 117	830	90
February	78	121 + 20 „ = 141	898	506
March	150	280 + 9 „ = 289	1,895	1,145
April	67	127 + 22 „ = 149	873	568
May	51	104 + 15 „ = 119	763	463
June	63	91 + 3 „ = 94	709	441
July	77	100 + 13 „ = 113	880	531
August	107	137 + 4 „ = 141	1,188	741
September	87	117 + 11 „ = 128	1,025	678
October	102	132 + 9 „ = 141	1,322	896
November	69	89 + 13 „ = 102	971	643
December	45	52 + 2 „ = 54	539	353
Total	317	1,446 +142 blind = 1,588	11,893	7,455

Appendix IV—*continued.*

C—NIGERIAN OIL-PALMS, NJALA, 1933.

COMPARATIVE YIELD OF TREES IN THE PLANTATION.

Yield in Kg. of fruit.		0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40	40–45	45–50	50–55	55–60	60–65	65–70	70–75	75–80	80–85	85–90	90–95	Total number of trees in the plot bearing in 1933.
Actual plot figures.	A ...	9	17	32	23	24	18	9	4	4	1	2	—	—	—	—	—	—	—	1	144
	B ...	5	12	20	27	22	19	13	10	7	4	5	6	2	2	1	1	1	—	—	157
	C ...	1	1	3	2	3	—	2	1	1	1	—	—	—	—	—	—	—	—	—	15
	D ...	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
	Total (Whole Plot) ...	15	30	55	52	50	37	24	15	12	6	7	6	2	2	1	1	1	—	1	317
Percentage of total number of bearing trees in the plot.	A ...	6·2	11·8	22·2	16·0	16·7	12·5	6·2	2·8	2·8	0·7	1·4	—	—	—	—	—	—	—	0·7	
	B ...	3·2	7·6	12·7	17·2	14·0	12·1	8·3	6·4	4·5	2·5	3·2	3·8	1·2	1·2	0·6	0·6	0·6	—	—	
	Whole Plantation	4·7	9·5	17·3	16·4	15·8	11·7	7·6	4·7	3·8	1·9	2·2	1·9	0·6	0·6	0·3	0·3	0·3	—	0·3	

Appendix IV—*continued.*

D—NIGERIAN OIL-PALMS, NJALA, 1933.

Comparison of Total Yield of Fruit of Individual Trees in the Plantation for the Eight Years, 1926–1933.

Yield in Kg. of Fruit.	0–20	20–40	40–60	60–80	80–100	100–120	120–140	140–160	160–180	180–200	200–220	220–240	240–260	260–280	280–300	300–320	320–340	340–360	Total number of trees in the plot bearing.
A	5	6	9	10	15	24	24	20	19	10	2	3	—	1	1	—	—	—	149
B	5	2	2	2	12	14	16	23	22	18	16	5	8	4	4	3	2	1	159
C	—	—	—	1	2	4	2	—	4	1	—	1	—	—	—	—	—	—	15
D	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1
Total ...	10	8	11	13	29	42	42	43	46	29	18	9	8	5	5	3	2	1	324

Ten trees have not yet borne fruit.

Appendix IV—*continued.*

E—NIGERIAN OIL-PALMS, NJALA, 1933.

	Average weight, heads kg.	Average weight fruit per head kg.	Percentage fruit in head.
January— A	7·1	3·6	50
B	9·9	6·3	64
Whole plot	8·6	5·1	59
February— A	7·1	3·5	49
B	7·8	4·7	61
Whole plot	7·4	4·2	56
March— A	6·0	3·4	57
B	7·8	5·0	64
Whole plot	6·8	4·1	60
April— A	6·4	4·0	63
B	7·3	4·9	67
Whole plot	6·9	4·5	65
May— A	8·2	4·6	57
B	6·8	4·4	64
Whole plot	7·3	4·5	61
June— A	6·9	4·1	60
B	8·4	5·5	63
Whole plot	7·8	4·8	62
July— A	7·8	4·2	54
B	9·4	6·2	64
Whole plot	8·8	5·3	60
August— A	7·4	4·3	58
B	9·6	6·3	65
Whole plot	8·7	5·4	62
September—A	7·7	4·9	63
B	9·7	6·6	68
Whole plot	8·8	5·8	66
October— A	9·4	6·2	66
B	10·5	7·3	70
Whole plot	10·2	6·8	68
November— A	9·9	6·3	64
B	11·8	8·1	69
Whole plot	10·9	7·2	66
December— A	8·6	5·3	62
B	12·0	8·2	68
Whole plot	10·4	6·8	66

Appendix IV—*continued.*

F—NIGERIAN OIL-PALMS, NJALA, 1933.

	Average Yield of Fruit per Tree.		Average Yield of Fruit per Acre (at 75 trees).	
	A (Number of trees fruiting, 144)	B (Number of trees fruiting, 157)	A	B
	kg.	kg.	kg.	kg.
January	0·9	2·1	69	160
February ...	1·2	2·0	88	153
March	3·4	3·9	252	295
April	1·6	2·0	119	151
May	1·2	1·6	89	123
June	1·3	1·6	95	119
July	1·0	2·4	72	177
August	1·7	2·8	127	207
September ...	1·7	2·6	130	192
October	2·8	2·7	213	206
November ...	1·8	2·1	138	159
December ...	1·0	1·3	72	98
Whole year ...	19·5	27·2	1,464	2,040

Average yield over all of fruit per fruiting tree, 23·5 kg. (Number of trees fruiting, 317.)

Average yield over all of fruit per acre (at 75 trees) 1,764 kg.

Appendix IV—*continued.*

G—NIGERIAN OIL-PALMS, NJALA, 1933.

MALE AND FEMALE INFLORESCENCES AT ANTHESIS IN DIFFERENT MONTHS.

—	Number of male inflorescences at anthesis.	Number of female inflorescences at anthesis.	Ratio of male to female inflorescences at anthesis.
January	310	106	2·9
February ...	259	107	2·4
March	218	149	1·5
April	254	176	1·4
May	261	155	1·7
June	126	79	1·6
July	26	57	0·5
August	185	120	1·5
September ...	438	230	1·9
October	647	269	2·4
November ...	528	194	2·7
December ...	433	103	4·2
Total for the year	3,685	1,745	2·1

Appendix IV—*continued.*

H—KAWEI OIL-PALMS, NJALA 1933.

(161 trees in their 9th year after planting.)

—	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of good heads harvested, kg.	Weight of fruit, kg.	Number of male inflorescences at anthesis	Number of female inflorescences at anthesis.	Ratio of male to female inflorescences at anthesis.
January ...	32	72 + 7 blind = 79	232·6	154·3	54	108	0·5
February ...	29	43 + 3 ,, = 46	114·4	73·8	43	118	0·4
March ...	70	182 + 18 ,, = 200	542·2	368·1	85	98	0·9
April ...	87	231 + 11 ,, = 242	810·9	565·8	52	65	0·8
May ...	84	191 + 20 ,, = 211	729·1	473·9	41	42	1·0
June ...	94	275 + 8 ,, = 283	847·8	529·4	10	9	1·1
July ...	60	99 + 7 ,, = 106	238·3	151·4	28	20	1·4
August ...	37	64 + 3 ,, = 67	178·0	113·2	156	73	2·1
September ...	37	70 + 3 ,, = 73	228·2	153·9	397	142	2·8
October ...	25	43 + 4 ,, = 47	185·9	126·5	416	191	2·2
November ...	11	19 + 3 ,, = 22	67·4	45·0	202	231	0·9
December ...	8	12 + 0 ,, = 12	45·5	28·9	78	160	0·5
Total ...	149	1,301 + 87 blind = 1,388	4,220·3	2,784·2	1,562	1,257	1·2

Average yield of fruit per bearing tree, 18·7 kg.

Appendix IV—*continued.*

J—HENOI OIL-PALMS, NJALA 1933.

(104 trees, in their 9th year after planting.)

	Number of trees from which heads were harvested.	Number of heads harvested.		Weight of good heads harvested, kg.	Weight of fruit, kg.	Number of male inflorescences at anthesis.	Number of female inflorescences at anthesis.	Ratio of male to female inflorescences at anthesis.
January ...	26	62 + 5 blind =	67	119·8	60·8	3	10	0·3
February ...	25	48 + 3 „ =	51	94·3	50·2	4	15	0·3
March ...	64	205 + 37 „ =	242	375·9	249·1	19	26	0·7
April ...	69	210 + 23 „ =	233	448·6	279·2	10	16	0·6
May ...	62	148 + 15 „ =	163	343·9	200·9	7	24	0·3
June ...	37	80 + 5 „ =	85	157·1	93·2	2	15	0·1
July ...	6	8 + 2 „ =	10	10·4	6·1	12	34	0·4
August ...	9	12 + 3 „ =	15	19·3	11·3	29	93	0·3
September ...	10	15 + 4 „ =	19	27·7	18·1	93	157	0·6
October ..	8	12 + 3 „ =	15	26·9	17·2	107	186	0·6
November ...	9	20 + 7 „ =	27	49·2	30·0	56	162	0·3
December ...	11	22 + 5 „ =	27	52·0	31·2	7	69	0·1
Total ...	96	842 +112 blind =	954	1,725·1	1,047·3	349	807	0·4

Average yield of fruit per bearing tree, 10·9 kg.

Appendix IV—*continued.*

K—KPOLEI OIL-PALMS, NJALA, 1933.

(74 trees in their 8th year after planting.)

—	Number of trees from which heads were harvested.	Number of heads harvested	Weight of good heads harvested, kg.	Weight of fruit, kg.	Number of male inflorescences at anthesis.	Number of female inflorescences at anthesis.	Ratio of male to female inflorescences at anthesis.
January ...	11	21 + 0 blind = 21	86·9	54·0	11	29	0·4
February ...	17	37 + 0 „ = 37	152·4	83·7	5	25	0·2
March ...	34	74 + 3 „ = 77	272·1	174·8	4	35	0·1
April ...	38	109 + 4 „ = 113	350·9	225·6	4	27	0·2
May ...	17	33 + 7 „ = 40	129·0	84·5	6	30	0·2
June ...	23	59 + 5 „ = 64	184·8	121·2	1	5	0·2
July ...	16	28 + 0 „ = 28	96·5	61·6	2	2	1·0
August ...	18	30 + 0 „ = 30	138·1	86·0	20	21	1·0
September ...	16	22 + 0 „ = 22	114·5	80·4	76	105	0·7
October ...	17	32 + 1 „ = 33	191·5	125·8	150	123	1·2
November ...	12	16 + 0 „ = 16	126·4	82·0	101	60	1·7
December ...	2	2 + 0 „ = 2	15·3	9·4	50	48	1·0
Total ...	67	463 + 20 blind = 483	1,858·4	1,188·8	130	510	0·8

Average yield of fruit per bearing tree, 17·7 kg.

Appendix IV—*continued.*

L—ANGOLA OIL-PALMS, NJALA, 1933.

(6 trees in their 7th year after planting.)

	Number of trees from which heads were harvested.	Number of heads harvested.	Weight of good heads harvested, kg.	Weight of fruit, kg.	Number of male inflorescences at anthesis.	Number of female inflorescences at anthesis.	Ratio of male to female inflorescences at anthesis.
January ...	4	6 + 0 blind = 6	29·1	11·7	1	7	0·1
February ...	5	9 + 0 „ = 9	29·0	14·3	0	15	0·0
March ...	5	16 + 0 „ = 16	69·2	40·3	0	13	0·0
April ...	3	7 + 0 „ = 7	30·6	19·0	2	10	0·2
May ...	5	11 + 1 „ = 12	49·1	34·3	4	8	0·5
June ...	5	10 + 0 „ = 10	39·0	26·7	4	0	0·0
July ...	6	12 + 0 „ = 12	50·2	30·2	1	1	1·0
August ...	6	15 + 0 „ = 15	80·6	49·2	0	0	0·0
September ...	4	8 + 0 „ = 8	33·4	23·0	0	8	0·0
October ...	3	7 + 0 „ = 7	37·7	23·9	16	16	1·0
November ...	2	3 + 0 „ = 3	15·4	9·1	11	5	2·2
December ..	0	0 + 0 „ = 0	0·0	0·0	9	6	1·5
Total ...	6	104 + 1 blind = 105	463·3	281·7	48	89	0·5

Average yield of fruit per bearing tree, 46·9 kg.

Appendix IV—*continued.*

M—NATIVE AND ANGOLA OIL-PALMS, NJALA, 1933.

	Average weight, head, kg.				Average weight, fruit, per head, kg.			
	Kawei.	Henoi.	Kpolei.	Angola.	Kawei.	Henoi.	Kpolei.	Angola.
January ...	3·2	1·9	4·1	4·8	2·1	1·0	2·6	1·9
February ...	2·7	2·0	4·1	3·2	1·7	1·0	2·3	1·6
March ..	3·0	1·8	3·7	4·3	2·0	1·2	2·4	2·5
April ...	3·5	2·1	3·2	4·4	2·4	1·3	2·1	2·7
May ...	3·8	2·3	3·9	4·5	2·5	1·4	2·6	3·1
June ...	3·1	2·0	3·1	3·9	1·9	1·2	2·1	2·7
July ...	2·4	1·3	3·4	4·2	1·5	0·8	2·2	2·5
August ...	2·8	1·6	4·6	5·4	1·8	0·9	2·9	3·3
September	3·3	1·8	5·2	4·2	2·2	1·2	3·7	2·9
October ...	4·3	2·2	6·0	5·4	2·9	1·4	3·9	3·4
November	3·5	2·5	7·9	5·1	2·4	1·5	5·1	3·0
December	3·8	2·4	7·6	—	2·4	1·4	4·7	—
Whole year	3·2	2·0	4·0	4·5	2·1	1·2	2·6	2·7

Appendix IV—*continued.*

N—DELI OIL-PALMS, NJALA, 1933.

(106 trees in their 3rd year after plainting.)

—	Number of trees from which heads were harvested	Number of heads harvested.	Weight of good heads harvested, kg.	Weight of fruit kg.	Number of male inflorescences at anthesis.	Number of female inflorescences at anthesis.	Ratio of male to female infloresc nces at anthesis.
January ..	2	2 + 6 blind = 8	2·2	0·9	81	11	7·4
February ...	3	5 + 1 „ = 6	8·5	3·9	79	10	7·9
March ...	4	9 + 8 „ = 17	13·7	8·6	86	0	—
April ...	3	3 + 9 „ = 12	4·3	2·9	99	16	6·2
May ...	5	9 + 11 „ = 20	7·6	4·4	51	7	7·3
June ...	2	3 + 11 „ = 14	4·4	2·4	21	4	5·2
July ...	5	9 + 2 „ = 11	8·5	4·9	64	13	4·9
August ...	1	1 + 4 „ = 5	0·6	0·3	83	32	2·6
September ...	3	5 + 3 „ = 8	7·2	4·4	121	87	1·4
October ...	4	6 + 0 „ = 6	16·0	10·0	69	114	0·6
November ...	6	8 + 6 „ = 14	23·4	15·2	82	67	1·2
December ...	4	4 + 2 „ = 6	12·2	8·6	75	49	1·5
Total ...	21	64 + 63 blind = 127	108·6	66·5	911	410	2·2

Average yield of fruit per bearing tree, 3·2 kg.

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